

QUARTERLY TECHNICAL PROGRESS REPORT

Report No.: 4 (final)

March 12, 1993 - January 12, 1994

Prepared: 1-13-94

FOR THE PERIOD OF:

Contract No.: NAS8-38609 Delivery Order No.: 70

Delivery Order Title: "Solid Rocket Motor Expert System"

Research Activities Performed:

- 1.0 Knowledge acquisition for SRM design and analysis of results
- 2.0 Design model base
- 3.0 Design rule base
- 4.0 Code for the prototype
- 5.0 Demonstration of prototype development in November and December of 1993
- 6.0 Final demonstration January 19, 1994

See appended document for additional detail. The longer report has been transmitted to Melissa VanDyke (Propulsion Laboratory, MSFC).

Problems Encountered:

None

(NASA-CR-193971) SOLID ROCKET
MOTOR EXPERT SYSTEM Final Report,
12 Mar. 1993 - 12 Jan. 1994
(Alabama Univ.) 4 p

N94-72155

Unclass

Z9/20 0014054

Research Activities Planned Next Month:

None



Dr. L. D. Interrante, Principal Investigator

Date:

Prepared for:

NASA / MSFC

ATTN: Ronald Smith/AP 29M

Marshall Space Flight Center, AL 35812

cc:

CN22D

<3>

AT01

<1>

EM13/L. Smith

<1>

ONRRR

<1>

Van Dyke/EP54

<1+repro>

NASA/Sci & Tech.

Info. Facility

<1+repro>

Vaughan/ UAH

<1>

<1 copy>

Summary of extended report

The purpose of this research is acquire and analyze the knowledge of solid rocket motor design and develop a prototype-demonstration knowledge-based system (KBS) tailored to the new engineer (0-5 years). In particular the system is to:

1. serve as an aid to SRM design and development,
2. give advice concerning SRM design changes, and
3. assist in the training of new SRM personnel.

The working prototype is has been delivered after two demonstrations and reviews. A final demonstration and report was given on January 19, 1993.

The SRM expert system is intended to be a tool that aids in the design of solid rocket motors (SRMs). Although there is software that can be used as an aid in the design of solid rocket motors, the focus of our system on the design process with attention to the needs of the new engineer is novel. The SRM expert system is designed to aid the engineer with less than six years of experience in the design of large solid rocket motors, arbitrarily defined as a SRM over forty inches in diameter that is a candidate for launch systems. This definition excludes upper stage motors such as IUS, TOS, or third stage Peacekeeper and will specifically include motors such as Castor, RSRM, ASRM, and possibly other motors. The expert system will enhance the capabilities of the target engineer primarily in two ways: first, by assisting when design changes are contemplated for an established design; and second, by assisting in SRM design and development. By the very nature of this system and the performance of these two primary functions, the system will be a valuable tool for training new personnel.

1.0 Project Description	1
2.0 Administrative History	1
Subtask 1.0: Establish a design and framework for the application.	
Subtask 2.0: Perform data acquisition using knowledge engineering techniques at he Solid Propulsion Branch at MSFC. UAH will gather data using knowledge acquisition techniques with SRM experts in the field; EP54 experts at MSFC will be available as requested.	
Subtask 3.0: Select development tools (hardware and software) used for building the expert system and build the interface between the tools.	
Subtask 4.0: Implement Applications and Software Checkout	
Subtask 5.0: Final Report	
3.0 A Vignette	3
4.0 Overview	6
4.1 Domain and Prototype	
4.2 Temporal aspects of the domain	
4.3 Component aspects of the domain	
5.0 Principles and guidelines	9
5.1 The target-end user is a new engineer 0-5 years.	

- 5.2 The system should be able to deliver knowledge about the design process based on the expertise and experience of engineers currently at work in this field.
- 5.3 The system being designed assumes that there is existing software for particular parts of the design process.
- 5.4 The system being designed will provide for access to the experience of rocket motor engineering through a simple case-based approach.
- 5.5 It is assumed that the engineering design process works in phases.
- 5.6 The system is being designed to enhance human potential.

6.0 Knowledge acquisition 11

- 6.1 Interaction with Sverdrup team
 - 6.1.1 Purpose
 - 6.1.2 Meetings
 - 6.1.3 Results
 - 6.1.4 "Blue papers"
- 6.2 Extended knowledge acquisition
 - 6.2.1 Overview of the sessions
 - 6.2.2 Summary of SRM design workshop
 - 6.2.3 Summary of individual knowledge acquisition sessions at AIAA
 - 6.2.4 Summary of individual knowledge acquisition sessions were at MSFC
 - 6.2.5 Knowledge acquisition conclusions

7.0 Design of the Prototype 17

- 7.1 Basic constructs
- 7.2 Filling in the constructs
- 7.3 The parameters
- 7.4 The phases
- 7.5 Evaluations
- 7.6 User's manual
- 7.7 Code

8.0 Comments and Conclusions 29

9.0 Suggestions 29

Appendices

- Appendix A — "Blue papers"
- Appendix B — User's Guide
- Appendix C — Notes